6.4 Conservation Compliance

The 1985 Food Security Act introduced the Conservation Compliance and Sodbuster programs to combat soil erosion. These programs require farmers to implement approved soil conservation systems on highly erodible land (HEL) in order to receive certain USDA program benefits. These programs, along with other measures, have significantly reduced erosion on U.S. cropland. In 1995, approved conservation plans were being applied to nearly 90 million acres of cropped HEL, while an additional 30 million acres of HEL were enrolled in the Conservation Reserve Program. Major soil conservation practices implemented include conservation cropping sequences, crop residue use, and conservation tillage.

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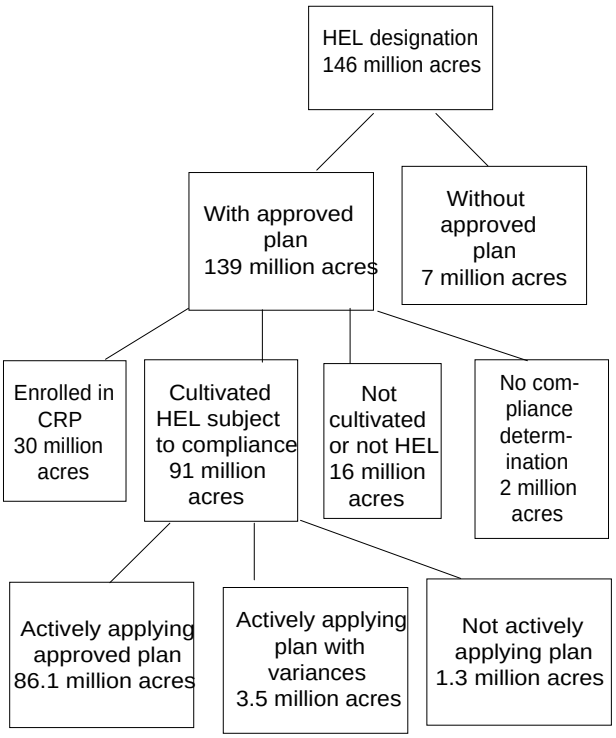
The Food Security Act of 1985 (1985 Farm Act) was drafted during a period of high agricultural support payments and growing concern about the environmental and productivity consequences of soil erosion. In 1982, cultivated HEL[1] accounted for nearly 60 percent of total erosion on U.S. cropland (USDA, NRI, 1994). The 1985 Farm Act introduced two new programs affecting farmers who cultivate crops on HEL: the Conservation Compliance Program and the Sodbuster Program.[2] Both programs required farmers to implement approved soil conservation systems on cultivated HEL in order to receive certain USDA program benefits. Conservation Compliance applied to HEL previously cultivated in any year between 1981 and 1985. It required farmers producing crops on HEL to implement and maintain a soil conservation system approved by the Natural Resources Conservation Service (NRCS) on that land by 1995. These conservation systems achieve a substantial reduction in soil erosion on a field or group of fields containing HEL. HEL placed into the Conservation Reserve Program (CRP) is also considered to be in compliance. The stricter Sodbuster Program applied to HEL not cultivated during 1981-85. Sodbuster required farm program participants bringing HEL under cultivation to apply basic soil conservation systems. Basic systems are intended to reduce soil erosion to the soil tolerance level (T): the rate above which long-term soil productivity may be depleted. This is a higher level of erosion control than often required under

[1] HEL cropland was estimated using NRI points with an erodibility index greater than or equal to 8. In practice, HEL cropland is a field, not a point determination.

[2] The Conservation Reserve Program was a third major program introduced in the 1985 Farm Act to control soil erosion (see chapter 6.3).

Figure 6.4.1--Status of highly erodible land, 1995



Source: USDA, ERS, based on NRCS 1995 Status Review.

Conservation Compliance. Under both programs, farmers who continued to cultivate HEL without implementing an approved conservation system would be ineligible to receive Commodity Credit Corporation price supports or payments, CRP payments, farm storage facility loans, disaster payments, Consolidated Farm and Rural Development or Farmers Home Administration loans, or Federal Crop Insurance. However, this provision was modified under the Food, Agriculture, Conservation and Trade Act of 1990, giving the Secretary of Agriculture discretion to determine that a person, although in violation, acted "in good faith" without the intent to violate Conservation Compliance requirements. In such cases, the person's payments may be reduced by not less than $500 nor more than $5,000, but the person would remain eligible to participate in USDA programs if the violation were corrected.

The Federal Agricultural Improvement and Reform Act (1996 Farm Act) made further changes in provisions governing cultivation on HEL. First, the 1996 Act made compliance no longer a requirement for Federal Crop Insurance. Second, the Act eliminated distinction between HEL cultivated from 1981 to 1985 and HEL brought under cultivation after 1985, doing away with the Sodbuster Program. Newly cultivated HEL may use conservation systems other than the basic systems previously required under Sodbuster. Alternative systems can be applied where they do not result in substantially higher soil erosion. However, alternative conservations systems may not always adequately prevent a substantial increase in soil erosion when converting HEL fields from native vegetation. In these cases, basic conservation systems may still be required.

The 1996 Farm Act also included several modifications to reduce compliance and monitoring costs. These include: (1) expedited variances for timely responses to producer requests for relief from climatic or economic hardship; (2) grace periods for good-faith violations to provide producers with unintended violations to come into compliance without penalty; (3) onfarm conservation research authority to examine innovative conservation systems; and (4) provisions to allow farmers to report residue measurements.

Status of Conservation Compliance: 1995

About 146 million acres, roughly one-third of total U.S. cropland, had been designated as HEL and potentially subject to Conservation Compliance.[3] In 1995, the first year conservation systems were to be fully applied and maintained, conservation plans had been approved for 139 million HEL acres (USDA, NRCS, 1996b). Of those acres with approved plans, 91 million were cultivated non-CRP HEL subject to compliance, while another 16 million acres were either not under cultivation in 1995 or were subsequently determined not to be HEL (USDA, NRCS, 1996a).[4] These acreage estimates can fluctuate with year-to-year changes in cultivated acreage. An estimated 30 million acres were enrolled in CRP and considered in compliance (USDA, FSA, 1997).[5] A remaining 2 million acres had not had compliance determinations. NRCS determined that approved conservation practices and systems were actively applied on over 86 million (95 percent) of the 91 million acres of non-CRP HEL subject to compliance (USDA, NRCS, 1996a). The proportion of HEL units determined as subject to compliance and

[3] This includes some non-HEL soils that are in fields that are predominantly HEL.

[4] Land not currently in cultivation could be planted in cover crops or be in other conserving uses.

[5] Acreage of HEL enrollled in CRP could not be estimated directly from the NRCS 1995 Status Review and had to be derived from other sources.

Table 6.4.1—Conservation compliance status, 1995

Region	Designated HEL in cultivated cropland subject to compliance[1]	Actively applying approved plan	Actively applying plan with variances	Not actively applying plan (violations)
	Acres		*Percent of operating units*[2]	
Northeast	2,457,859	93.9	2.8	2.4
Appalachian	4,719,538	96.5	2.4	1.1
Southeast	1,021,934	98.3	0.7	0.5
Lake States	4,004,279	95.7	2.3	1.5
Corn Belt	18,662,889	90.3	7.6	2.0
Delta States	758,134	98.1	0.0	0.6
Northern Plains	23,683,540	94.3	4.2	1.5
Southern Plains	11,934,394	97.8	1.5	0.7
Mountain States	19,417,899	98.3	0.7	0.5
Pacific	4,306,341	92.4	5.5	2.0
Total/average	90,987,369	94.6	3.8	1.4

[1] Acreage total excludes HEL in the CRP.
[2] The percentage of acres in each compliance status determination is not known because the determination was made on an operating unit basis. However, the percentage of units in each status designation is an indicator of the relative acreage. The rows may not sum to 100 percent due to rounding, and because HEL cropland falling in "other" (includes, for example, wetlands on HEL or acres not required to apply plans) has been omitted.
Source: USDA, ERS, based on NRCS 1995 Status Review of Conservation Compliance.

not actively applying an approved conservation plan declined from 2.9 to 1.4 percent between 1994 and 1995 (USDA, 1994b and 1996a).

Only a small proportion of HEL cropland is not in compliance, although variances can be important in some regions. Based on survey estimates, about 1.3 million acres of HEL were estimated to be in violation (not actively applying an approved plan) in 1995. This represents just 1.4 percent of the 91 million acres of HEL cropland subject to compliance (USDA, 1996a). The Northeast had the highest percentage of units estimated to be in violation, while the Southeast had the lowest percentage (table 6.4.1). In 1995, the Corn Belt and Pacific regions had the highest percentages of units receiving climatic and hardship variances. Variances are offered to producers when climatic conditions prevent implementation of the full conservation plan, as when a drought prevents the establishment of a cover crop. Hardship variances are offered when circumstances such as family illness or crop failure prevent a farm from implementing the conservation plan. Because drought or floods can be widespread, variances can be important, not only for individual farmers, but also for broader production regions. The Northern and Southern Plains, Mountain States, and Corn Belt accounted for 80 percent of HEL acreage subject to conservation compliance in 1995 (table 6.4.1). In all regions, more than 90 percent of operating units with HEL subject to compliance were actively applying and maintaining an approved conservation system.

Since 1986, violations of the HEL conservation subtitle have resulted in $13.6 million in denied benefits on over 200,000 acres of cropland (table

Table 6.4.2—Benefits denied under the conservation compliance and sodbuster programs, 1986-95

Year	Producers found in violation	Land in violation	Value of benefits denied	Producers with all benefits denied
	Number	*Acres*	*Dollars*	*Number*
1986	2	10	10,834	2
1987	66	3,289	224,328	66
1988	174	3,745	530,974	174
1989	83	2,957	238,239	83
1990	342	60,295	1,555,209	342
1991	584	42,675	2,928,188	nd
1992	693	38,503	1,803,250	nd
1993	859	36,252	3,232,378	341
1994[1]	632	25,933	2,087,251	261
1995[2]	118	3,266	955,215	40
Total	3,553	216,925	13,565,866	1,309[3]

nd = no data available. [1] Preliminary. [2] As of December 11, 1995. [3] Number is incomplete because no information is available for 1991 and 1992.
Source: USDA, ERS, based on USDA, FSA, 1996.

Table 6.4.3—Conservation management systems and technical practices being applied on cultivated HEL subject to compliance (excluding CRP), 1995

Item	Acreage	Percent of cultivated HEL[1]
Management systems		
Conservation cropping sequence/crop residue use	27,443,973	30.2
Conservation cropping sequence/conservation tillage	9,081,148	10.0
Conservation cropping sequence only	6,249,209	6.9
Crop residue use only	4,041,388	4.4
Conservation cropping sequence/conservation tillage/grassed waterways	2,027,771	2.2
Conservation cropping sequence/conservation tillage/contour farming/grassed waterways/terrace	1,958,476	2.2
Conservation cropping sequence/contour farming/crop residue use/terrace	1,896,080	2.1
Conservation cropping sequence/crop residue use/wind stripcropping	1,768,605	1.9
Conservation cropping sequence/contour farming/crop residue use/grassed waterways/terrace	1,665,697	1.8
Conservation cropping sequence/conservation tillage/crop residue use	1,602,604	1.8
Total, 10 most frequently used systems	57,734,951	63.5
Technical practices[2]		
Conservation cropping sequence	75,632,767	83.1
Crop residue use[3]	48,294,496	53.1
Conservation tillage[3]	28,477,584	31.3
Contour farming	18,046,999	19.8
Terrace	12,868,684	14.1
Grassed waterway	10,842,932	11.9
Field border	4,442,198	4.9
Wind stripcropping	3,508,340	3.9
Cover and green manure	3,169,983	3.5
Surface roughing	3,018,871	3.3
Grasses and legumes in rotation	2,424,281	2.7
Stripcropping-contour	1,699,477	1.9
Critical area planting	1,545,287	1.7
Pasture and hay land management	1,126,426	1.2

[1] Based on 91 million acres of cultivated HEL subject to compliance.
[2] Because many conservation systems include multiple technical practices, percentages will sum to more than 100.
[3] Conservation tillage and residue mangement are often combined and reported as a single practice, conservation tillage.
Source: USDA, ERS, compiled from NRCS data, 1996.

6.4.2) (USDA, FSA 1996). Violations prior to 1990 were Sodbuster violations that occurred when HEL was brought into production without an approved conservation management plan, causing farmers to be ineligible for USDA benefits. After 1990, all farmers participating in USDA programs were to have approved conservation plans on HEL cropland. Persons without approved conservation plans or who were not implementing them on schedule could be found in violation of the conservation compliance provision.

Conservation Plans and Systems

Conservation plans specify economically viable conservation systems which substantially reduce erosion. Conservation systems are composed of one or more conservation practices. The 1995 status review provides the first assessment of fully implemented conservation systems under Conservation Compliance. Although the 1995 status review found over 4,000 different conservation systems (combinations of practices) applied nationwide, four conservation systems involving conservation cropping sequences, crop residue use, or a combination of these practices with conservation

Table 6.4.4—Technical practices included in conservation plans in Iowa, North Carolina, North Dakota, and Oklahoma, 1995

Technical practice	Iowa	North Carolina	North Dakota	Oklahoma
		Percent of conservation plans[1]		
Conservation crop rotation	87.1	82.0	99.0	9.9
Conservation tillage	79.2	30.6	0.4	3.5
Residue management	.7	50.5	98.4	92.3
Contour farming	44.4	24.3	--	5.4
Strip cropping field border	32.3	15.0	--	--
Strip cropping - contour	2.3	0.0	--	--
Strip cropping field	--	5.0	--	--
Strip cropping wind	--	--	0.6	0.3
Grassed waterway - retired[2]	24.9	21.9	0.7	8.2
Grasses & legumes in rotation	1.0	7.2	0.0	--
Cover and green manure crop	0.0	5.1	1.5	.3
Conservation cover - retired[2]	0.0	13.6	3.0	0.5
Critical area planting - retired[2]	0.8	4.3	0.1	0.6
Terrace	13.4	1.2	0.0	0.2
Pasture & hay land management	13.7	5.9	0.2	22.5
Pasture & hay land planting	1.3	6.3	0.4	0.3

-- indicates less than 0.1 percent.
[1] Because many conservation systems include multiple practices, percentages will sum to more than 100.
[2] Retired indicates land taken out of production.
Source: USDA, ERS, based on NRCS 1995 Status Review.

tillage covered half of HEL cropland (table 6.4.3). Conservation cropping sequences were included in the conservation systems applied to 83 percent of non-CRP HEL, and either conservation tillage or crop residue use was applied to 84 percent. Terraces, which require a significant capital investment, were used in 14 percent of conservation systems. Practices taking land out of crop production—such as grassed waterways, field borders, and critical areas plantings—are included in 12, 5, and 2 percent of the plans.

Adoption of particular conservation systems varies with climate, topography, soils, predominant crops, and pre-existing production practices. A system or practice acceptable in one location may not be feasible in another. The effectiveness of a system in controlling erosion depends on several factors, including the frequency, timing, or severity of wind and precipitation; the exposure of land forms to weather; the ability of exposed soil to withstand erosive forces; the plant material available to shelter soils; and the propensity of production practices to reduce or extenuate erosive forces.

A comparison of Iowa, North Carolina, North Dakota, and Oklahoma illustrates how local environmental conditions affect farmers' adoption of particular conservation systems. In the relatively homogeneous Northern Plains, there are few economically viable alternatives to a wheat/fallow rotation. Thus, in North Dakota, the conservation crop sequence/crop residue management system was part of nearly all conservation systems on cropped HEL (table 6.4.4; USDA, NRCS, 1996a). Similarly, in the Southern Plains, wheat is the predominant crop, with few economically viable alternatives. In Oklahoma, most conservation systems consist of a single technical practice—crop residue management. Both the number of feasible conservation systems and the number of systems required to control erosion are greater in areas with greater climatic and geographic variability. Iowa produces predominantly corn and soybeans, and has a higher average rainfall and a more varied topography than North Dakota and

Table 6.4.5—Land use and erosion changes on cultivated HEL and non-HEL, 1982-92

Region	Land use change				Erosion change[2]		
	Small grains	Row crops	CRP land[1]	Other ag.	Wind	Water	Total
HEL cropland[3]	*1,000 acres*				*Tons/acre/year*		
Northeast	-20.7	-391.1	95.7	-212.7	-2.01	0.00	-2.01
Appalachian	-530.1	-1,782.6	784.8	86.7	-5.30	-0.06	-5.36
Southeast	-192.3	-793.3	501.3	112.2	-5.82	0.00	-5.82
Lake States	-372.6	20.8	893.2	-244.3	-4.05	-0.71	-4.76
Corn Belt	-1,693.4	-1,818.5	2,996.9	-110.6	-8.53	-0.57	-9.11
Delta States	-86.7	-1,186.4	537.0	-135.4	-8.04	0.00	-8.04
Northern Plains	-2,081.6	-1,760.7	4,615.5	-890.3	-1.60	-2.61	-4.21
Southern Plains	-380.2	-1,939.3	3,265.4	-407.1	-0.49	-9.91	-10.00
Mountain States	-1,990.5	-1,084.5	5,225.3	-433.5	-0.75	-2.82	-3.57
Pacific	-527.1	-78.5	881.1	238.2	-4.20	-0.74	-4.94
Total HEL	-7,898.6	-10829.5	19,796.2	-2,001.7	-3.18	-2.69	-5.87
Non-HEL cropland							
Northeast	-94.1	-764.1	109.3	438.6	0.57	-0.00	0.57
Appalachian	-33.6	-1,454.5	291.4	726.7	0.39	0.01	0.40
Southeast	-676.3	-2,879.2	1,020.8	513.9	-0.31	0.00	-0.31
Lake States	-2,421.7	167.0	1,837.1	79.9	-0.15	0.05	-0.06
Corn Belt	-1,731.3	-183.2	2,139.0	1,017.0	-0.52	-0.52	-1.04
Delta States	156.3	-2,586.1	616.7	1,339.1	-0.45	0.00	-0.45
Northern Plains	-4,854.5	3,791.9	4,268.9	-601.5	-0.18	-1.60	-1.77
Southern Plains	-3,399.5	-1,733.8	1,870.7	314.5	0.06	-1.59	-1.53
Mountain States	-1,923.3	142.0	1,252.0	-505.0	-0.18	0.49	0.31
Pacific	-1,955.1	-520.5	837.9	693.7	-0.15	0.20	0.05
Total Non HEL	-16,008.1	-5,967.7	14,243.8	4,016.9	-0.20	-0.61	-0.82

[1] CRP in 1992, but cropland in 1982.
[2] Average erosion change on cultivated and CRP lands in 1992.
[3] HEL cropland refers to NRI points with an EI of 8 or greater.
Source: USDA, ERS, based on Kellogg and Wallace, 1995.

Oklahoma. Thus, in Iowa, a larger number of conservation systems are used, most frequently conservation cropping sequences and conservation tillage. North Carolina has a variable topography with diverse soils and precipitation patterns, and produces sizable quantities of wheat, corn, soybeans, cotton, sorghum, and tobacco. Here, the conservation systems are even more varied.

Erosion Reduction on HEL

Evidence from the National Resources Inventory (NRI) suggests that focusing conservation efforts on HEL was effective in reducing soil erosion on HEL. Between 1982 and 1992, estimated rates of soil erosion on U.S. cropland declined an average of 2.8 tons per acre per year (tay) (USDA, 1994).[6] Estimated erosion on cropped HEL declined at an even higher rate, 5.9 tay on average (USDA, 1994a, table 6.4.5). Since 1985, Conservation Compliance, Conservation Reserve, and Sodbuster all worked to reduce soil erosion on HEL directly. Other changes in commodity programs affected soil erosion indirectly by altering producer returns, changing

[6] The rate of soil erosion is estimated using the Universal Soil Loss Equation and the Wind Erosion Equation. Both consider factors such as the erodibility of the soil material, the slope and slope length, climatic conditions, land use, vegetative cover, and conservation practices. The factors that producers can reasonably change to alter soil erosion are land use, vegetative cover, and conservation practices.

relative profitability between commodities, and changing land use and production practices.

With more complete implementation of conservation systems since 1992, the erosion on cultivated HEL has declined further. In 1995, the implemented conservation systems reduced average soil erosion to less than the soil tolerance level (T) on 44 million acres, nearly half of HEL cropland subject to compliance (USDA, NRCS, 1996a). On most of the balance, average erosion was less than 2T. In 1995, erosion on HEL averaged 9.2 tay less than it did prior to installing and maintaining approved conservation systems. Not all of this reduction can be attributed to Conservation Compliance. Changes in market and program prices and technological innovations also affect the adoption of conservation systems. Some conservation practices now in place on HEL would have been applied even without the program and some were in place before the program.

Costs and Benefits of Conservation Compliance

While fully implemented conservation plans provide erosion control benefits, reducing soil erosion has a cost shared by farmers, consumers, and taxpayers. These costs and benefits can vary widely across individuals and regions. Conservation compliance requirements can increase production costs for farmers by idling or retiring cropland, substituting more expensive production practices, or requiring the purchase of new equipment. Consumers can be affected by changing market prices, as competitive commodity markets transmit changes in the cost of production. Other costs include the administrative costs of the compliance programs, which are borne by taxpayers (see box, "Summary of Reports Assessing Conservation Compliance," p. 309).

Benefits

Erosion control provides both onsite productivity benefits to farmers and off-site benefits from lower environmental damages. Reducing soil erosion helps maintain soil quality and land productivity. Erosion control reduces the water pollution associated with sediment, attached nutrients, and pesticides deposited into rivers, lakes, and streams. It also lowers maintenance costs for irrigation facilities and waterways and increases the service life for dams by reducing the amount of storage area lost to sedimentation. Reducing wind erosion lowers costs of cleaning wind-blown soil from machinery and household items.

Water and air quality benefits of erosion control are uncertain because of the difficulties in predicting weather patterns and other physical processes such as runoff and leaching. However, Ribaudo and Young (1989) estimated the national off-site benefits from controlling soil erosion to be 56 cents per ton, or $9 billion dollars per year. This includes commercial and recreational uses, water storage, and reduced flood damage, but ignores health and aesthetic benefits, as well as any interactions between changes in soil erosion and chemical leaching effects. Piper and Lee (1989) estimated the benefits of reduced damage from wind erosion at $0.30-$1.96 per ton abated.

Costs

The costs of Conservation Compliance in a given region or to individual producers within a region depend on several factors. These include the distribution of HEL cropland, the resource attributes of operations, and the production alternatives available to producers. In some cases, implementation of a Conservation Compliance plan entails little or no additional production costs. For example, conservation tillage and residue management systems reduce fuel, labor, and/or machinery costs (Bull, 1996; Fox, et al., 1991; Miller, 1996). These systems are being adopted not only on HEL subject to compliance, but on other lands as well. In other cases, compliance requires farmers to take acreage out of production or to make significant capital investments. As shown earlier, Iowa and North Carolina have a much higher percentage of plans with higher cost practices—such as terraces, critical area plantings, grassed waterways, border strips, and filter strips—than do North Dakota and Oklahoma (table 6.5.4). Even within States, there can be considerable variation in the reliance on higher cost practices.

The net costs of individual cropping practices may also vary across different physical settings. Some practices will entail little or no cost in some areas, but be costly in others. For example, conservation cropping rotations can entail only minor changes (or no changes) from pre-existing crop rotations, such as reduced grazing of winter wheat to maintain sufficient residue cover. In other cases, conservation rotations may require farmers to establish non-revenue producing winter cover crops or to add a year to a rotation, reducing producer returns. These more costly practices are often required for crops that leave little crop residue or that require substantial soil disturbance such as sugar beets, potatoes, or peanuts. Terracing is another practice with net returns sensitive

Table 6.4.6—Benefits and costs of conservation compliance, regional estimates[1]

Region	Per-acre benefits from--			Per-acre costs to--		Net economic benefits	Benfit/cost ratio
	Water quality	Air quality	Productivity	Producers	Federal Government		
	Annual 1993 dollars per acre						
Northeast	35.63	0	0.16	3.57	3.43	28.80	5.12
Lake States	21.99	0	0.12	0.32	3.43	18.37	5.90
Corn Belt	15.61	0	0.25	8.90	3.43	3.53	1.29
Northern Plains	3.47	3.00	0.19	3.35	3.43	-0.11	0.98
Appalachia	23.58	0	0.24	3.51	3.43	16.89	3.43
Southeast	25.63	0	0.12	8.18	3.43	14.15	2.22
Delta	35.50	0	0.12	1.97	3.43	30.22	6.60
Southern Plains	5.26	4.63	0.33	2.34	3.43	4.45	1.77
Mountain	5.10	4.01	0.15	0.20	3.43	5.63	2.55
Pacific	31.83	1.09	0.14	2.23	3.43	27.40	5.85
United States	13.81	1.93	0.21	3.78	3.43	8.74	2.21

[1] For procedures used, see box "Measuring the Benefits and Costs of Conservation Compliance." Onsite benefits based on USDA (1986) and SCS March 1994 status review. Offsite benefits are based on Ribaudo (1989), Huszar (1989), and SCS status review. Costs are based on Barbarika and Dicks (1988), SCS status review, and SCS staff-year projection. U.S. figures are weighted means of regional numbers, based on HEL acreage by region.

Source: USDA, ERS, based on Canning, 1994.

to local conditions. The capital expenditure, maintenance cost, and opportunity cost of land taken out of production associated with installing terraces generally exceeds the discounted benefits. However, in drier environments, the increased yield from moisture conservation can result in the discounted benefits exceeding costs (Clark, et al., 1985).

In North Dakota, Iowa, and Oklahoma, pasture and hay land management includes periodic cropping of pasture land to improve ground cover, control weeds and address problems on root-bound lands. These conservation measures, which provide more productive pasture and hay land, tend to increase net farm revenues. However, in some States, pasture and hay land management reflects a shift from cropping to a less intensive and less profitable use.

Conservation Compliance also has administrative costs, ideally measured as the difference between costs with and without the program. NRCS estimated that 6,000 staff-years would be required to administer the Conservation Compliance program in 1994, with staff-year requirements declining by one-half in 1995, and further in later years. Two important figures are absent from these data: (1) how the conservation provision influenced the total size of NRCS staff years, and (2) whether any services previously provided by existing staff were phased out due to compliance duties (Canning, 1994).

Comparing Costs and Benefits

Canning (1994) estimated the national benefits of Conservation Compliance (table 6.4.6) to be $15.95 per acre, with water quality improvements the largest source of benefits ($13.81 per acre). The estimated national cost was $7.21 per acre, shared fairly evenly by producers and government. Costs borne by farmers/landowners are offset by improvements in long-term soil productivity. Taxpayers pay the administrative costs of the program, including cost-share assistance, in return for the public benefits from improved air and water quality. These estimates lead to a benefit/cost ratio of 2.2, indicating that, on average, over two dollars of benefits are being obtained for each dollar of cost.

Benefit/cost ratios range from 0.98 in the Northern Plains States, the region with the greatest amount of HEL, to 6.60 in the Delta States (table 6.4.6). Four regions—the Northeastern, Lake States, Delta States, and Pacific—had benefits exceeding costs by a ratio of more than 5 to 1.[7] The Delta States region was the only region with both a large reduction (8 tons per acre per year) in the estimated rate of soil erosion and a high benefit/cost ratio. The Corn Belt and the

[7] The Corn Belt includes Illinois, Indiana, Iowa, Missouri, and Ohio; the Delta States includes Arkansas, Louisiana, and Mississippi; and the Southern Plains is composed of Oklahoma and Texas.

Measuring the Benefits and Costs of Conservation Compliance

The benefit and cost estimates presented in table 6.3.3 are based on a combination of sources. A March 1994 status review provides detailed information related to the goals and accomplishments of the conservation compliance provision. This information is translated into monetary estimates of annual benefits and costs using studies that estimate the economic impacts of soil erosion to households, firms, and municipalities.

Water Quality

Several studies have looked at the relationship between water quality and soil erosion from farmland. Ribaudo (1989) estimated the value of total annual damage caused by soil erosion from all sources to the quality of water used by households, industry, and municipalities in the 10 farm production regions. The damages from cropland erosion per ton can be estimated by multiplying Ribaudo's regional damage estimate by cropland's percentage of total sediment delivery, and dividing the result by the region's total annual erosion from cropland. Multiplying the water quality damages per ton of soil erosion for each region times the erosion reduced by compliance in that region provides an estimate of compliance's water quality benefits in that region.

Air Quality

Air quality is affected by wind-blown soil, which accounts for much of the erosion west of the Mississippi River. Like water-based erosion, a damage function for wind erosion depends on the use value of the damaged good and on the total volume of wind erosion. Huszar (1989) uses contingent valuation techniques to determine the annual damage per household per ton of wind-blown dust in New Mexico. As with water-based soil erosion, marginal wind-blown soil abatement benefits are smaller in sparsely populated areas, and where the total volume of wind erosion is large relative to the reduction achieved by compliance. Huszar's damage function is applied to estimate county-level impacts of a reduction in wind erosion from conservation compliance in all regions west of the Mississippi River. These estimates are then aggregated to farm production regions. In eastern regions, wind erosion damage is not estimated, although it is a problem in some areas. The estimates include only household-related damage. Inclusion of dust damage to firms, health, and recreation would increase the damage values.

Productivity

Onfarm benefits of soil conservation have been estimated by USDA (1986) as the net current value of future productivity gains to soil per ton of erosion abatement. Weighting the USDA value per ton of soil conservation for each soil group by the percentage of acreage in each soil group for each county with significant HEL acreage provides estimates of the onfarm net present value per ton of soil conservation. Multiplying this value by soil savings from conservation compliance and annualizing these benefits (based on a 4-percent discount rate) gives estimates of annual productivity gains.

Producer and Government Costs

Conservation compliance costs of producers are estimated at the field level. For HEL fields that need only conservation tillage, crop rotation, or other residue management (no structures), compliance cost is assumed to be zero. Barbarika and Dicks (1989) assumed a no-cost transition to conservation tillage when this was all that was required for full compliance. In a national survey reported by Esseks and Kraft (1993), 1 in 5 producers subject to compliance expected to incur costs, and under 1 in 20 expected significant costs. Where structures are prescribed by SCS, one of two equations (depending on whether or not conservation tillage is already applied to the field), estimated by Barbarika and Dicks, is used to relate annual installation and maintenance costs per acre to the level of soil erosion and the size of the treated field. Since the Barbarika and Dicks equations include the value of SCS technical assistance, this value is deducted from annual costs to avoid double-counting government costs.

Government costs of carrying out compliance are based on the value of continuing staff time per acre. USDA's budgeted annual staff years devoted to compliance duties are projected to level off at just under 2,000 by 1996. To be consistent with Barbarika and Dicks, opportunity costs are set at $82 per staff hour ($62.50 per staff hour in 1985 dollars converted to 1993 dollars). Compliance acres are estimated at 100 million, 86 percent of total HEL acreage (Esseks and Kraft,1993), less 28 million acres enrolled in the CRP. The startup costs of compliance, such as the staff years devoted to HEL determinations and development of conservation plans, are not included since they would amount to very little on an annualized basis.

Southern Plains had comparable reductions but lower per-acre benefits and higher costs.

Changes in Commodity Programs Affect Incentives for Compliance

The Conservation Compliance Program requires farmers growing crops on HEL cropland to implement an approved soil conservation plan in order to participate in commodity programs. This requirement directly links incentives offered by commodity programs with soil conservation goals. Prior to the FSA of 1985, commodity programs provided farmers with incentives to bring land into production and encouraged cultivation of erosive crops (Reichelderfer, 1985). In some cases, land brought into production was vulnerable to soil erosion. Cultivating lands vulnerable to erosion need not in itself be a problem if farmers adopt appropriate soil conservation measures. However, in many cases farmers may not have had a private incentive to do so. Conservation Compliance attempts to use commodity programs benefits to encourage farmers to adopt soil conservation practices.

Linking program benefits to conservation efforts also means that the *size* of the commodity program benefits can affect farmers' incentives to adopt soil conservation practices. Conservation Compliance requirements do not apply to producers not participating in programs. Changes in program benefits and compliance costs can influence program participation and the effectiveness of the Conservation Compliance Program. Between 1986 and 1995, commodity corporation outlays to the seven major program crops have decreased from $18.6 billion to $4.1 billion. Over this period, program participation also declined. Large changes in benefits are more likely to affect farmer incentives to participate in programs where costly conservation systems are required. Farmers using conservation systems that are cost-saving or cost-neutral will be more likely to retain these systems even if benefits decrease.

Changes in the *design* of commodity programs can also affect farmer incentives to participate in programs and to meet Conservation Compliance requirements. The 1996 Farm Act replaces the previous target price-deficiency payment system with a system of fixed annual payments. Under the previous system, farmers received payments based on the difference between the market price and a pre-determined target price for a portion of their production. Deficiency payments would rise when prices were low, but decline in years when prices were high. Farmers' program payments and their incentives to participate in programs would decline in high-price years. Under the 1996 Farm Act, payments to producers do not automatically decline in years when commodity prices are relatively high, so higher prices are less likely to reduce incentives to meet Conservation Compliance. The 1996 Farm Act also expands planting flexibility, increasing the attractiveness of program participation. It allows producers to make more market-based planting decisions by eliminating Acreage Reduction Programs that required farmers to take acreage out of production in some years as a condition of receiving program payments. It also eliminated many planting restrictions for producers of grains and upland cotton.

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Glossary

Approved conservation system—A set of field-specific cropping and managerial soil conservation practices designed in cooperation with local NRCS agents to reduce soil erosion. Basic conservation systems, which pertained to Sodbuster lands until 1996 and may be applied to other HEL, reduce erosion to the soil tolerance level (see definition below). Alternative conservation systems provide a significant level of erosion reduction without excessive economic burden on producers for land subject to conservation compliance.

Applied conservation system—An approved conservation system that has been applied and is being maintained, based on standards contained in the NRCS field-office technical guide.

Conservation Compliance provision—Since 1985, the conservation provision requires all farmers producing on HEL who receive or request certain USDA benefits to have an approved conservation system applied on those lands. Violations may result in disqualification from USDA programs or reduction of benefits.

Conservation cropping sequence—A crop rotation (multi-year sequence of crops) designed to improve or maintain good physical, chemical, and biological conditions of the soil; help reduce soil erosion; improve water use efficiency and water quality; improve wildlife habitat; or break reproduction cycles of plant pests.

Erodibility index (EI)—The natural erosion potential of a soil divided by the soil's tolerance level.

Field—A contiguous tract of land under a single farm operation and isolated by permanent barriers, such as fences, waterways, or woodland.

Highly erodible land (HEL)—Designations made by NRCS field staff include cropland in fields that have at least one-third or 50 acres (whichever is less) of highly erodible soils. HEL soils were defined as those soils with an erodibility index (EI) greater or equal to eight. An EI of 8 indicates that without any cover or conservation practices, the soil will erode at a rate 8 times the soil tolerance level. HEL designations currently total 146 million acres. This number has changed over time as more producers apply for benefits and more determinations are made.

Soil tolerance level (T)—The rate of soil erosion that can continually occur without reducing that soil's productivity.

Tract or operating unit—All fields farmed by a single operator. The entire unit is subject to the penalties of noncompliance, provided any field in the unit is determined to be highly erodible and the operator of that field has not applied or maintained the approved conservation system before receiving certain USDA program benefits.

Variances—Variances are offered to producers when **climatic** conditions such as flood or drought prevent implementation of the full conservation plan. One example would be where a drought prevented the establishment of a cover crop. **Hardship** variances are offered when circumstances such as family illness or crop failure prevent a farm from implementing the conservation plan. Because drought or floods can be widespread, variances can be important for not only individual farmers but also production regions.

Violations/disqualifications—Determined by FSA on recommendations of NRCS field staff, based on the guidelines of the approved conservation system. Before January 1, 1995, they occurred when an HEL field failed to have a partially applied conservation system by specified interim deadlines. After January 1, 1995, they occur when an operator requests or receives certain USDA program benefits without fully applying or maintaining an approved conservation system on HEL. Operators can request the development of a new plan or may be granted a temporary variance.

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Summary of Reports Assessing Conservation Compliance

USDA Natural Resource Conservation Service Status Reviews

Each year, NRCS randomly selects 5 percent of all HEL tracts nationally to conduct a status review. Tracts receiving variances are visited each year, as are tracts referred to NRCS by other agencies or whistle blowers. For each review, an NRCS soil conservationist visits the fields to determine if a developed conservation system is being implemented properly. Erosion rates are estimated, then inadequacies are either reported to agencies administering Federal farm programs or farmers are granted a variance. NRCS provides farmers with specific instructions to bring the tract into compliance. Recent changes in the review process now target HEL that is enrolled in Federal farm programs, and thus subject to compliance. A detailed evaluation of program implementation in several States serves as an internal quality control of program administration.

U.S. General Accounting Office (1994)

GAO evaluated progress made by NRCS in implementing the Conservation Compliance and Swampbuster programs established in 1985. A previous GAO evaluation (1990) had indicated that NRCS needed to improve the quality of the farmers' conservation plans and improve enforcement activities. GAO examined whether recent NRCS reforms addressing the concerns of the previous evaluations had resulted in improvements in the management and effectiveness of Conservation Compliance and Swampbuster. GAO concluded that while there were positive aspects of the reforms, NRCS still needed to improve its enforcement activities through better managed status reviews and by establishing clearer authority of State and county offices over conservation plans and wetland identifications. GAO also recognized that effective enforcement of conservation plans and swampbuster requires a change in the "culture" of NRCS, a change that acknowledges NRCS' newer, more regulatory role rather than its traditional role of advising farmers.

USDA Office of Inspector General (1995)

The Office of Inspector General (OIG) audited the Conservation Compliance Provisions to determine if producers complied with conservation requirements on HEL and whether the provision was effective in reducing erosion. In the 30 counties audited, OIG found that management practices reduced erosion from 9.5 tons per acre per year (tay) to 5.1 tay. They found that the plans tended to overestimate the rate of erosion associated with the conservation plans. Forty-seven percent of the tracts audited had rates of erosion at or below their soil loss tolerance. OIG concluded that the tolerance level can be achieved on all HEL fields. Despite the low level of erosion, 21 percent of the sampled tracts were not in full compliance. Forty percent of the tracts received a total of $212,000 in government benefits while having an erosion rate in excess of the minimum acceptable level of 7.2 tay. To provide a more accurate picture of the state of erosion control, OIG recommended that NRCS: (1) develop better measures of progress in reducing erosion and include these in the status review; (2) develop measures to evaluate relationships between soil loss levels—before, planned, alternative conservation plans, current—and tolerance; (3) provide more specific guidance to state and local administrators on identifying and treating ephemeral gully erosion, and (4) provide a consistent set of factors in estimating wind and other erosion.

U.S. General Accounting Office (1995)

GAO evaluated three aspects of Conservation Compliance: implementation flexibility in USDA across different regions of the country, differences in farming practices and the associated cost of compliance, and benefits and drawbacks of the program. Flexibility has been increased by allowing state offices to develop alternative conservation practices to satisfy regional standards for erosion. GAO found that: (1) three quarters of farmer conservation plans specified residue management as the primary control technique; (2) use of reduced tillage increased 30 percent between 1990 and 1994, and (3) no comprehensive data were available on the effect of conservation plans on production costs. A review of studies on compliance costs found mixed results. Factors leading to these mixed results include crop characteristics, soil type, climate, and farming practices. Studies of conservation tillage methods have shown both higher and lower returns to farmers, depending upon yield effects and changes in pesticide applications. GAO identified reduced soil erosion and improved surface water quality as environmental benefits that were potentially offset by increased pesticide and herbicide applications.